

Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2017-152, <http://www.atmos-chem-phys-discuss.net/acp-2017-152/>

Interactive comment on “Importance of the Saharan Heat Low on the control of the North Atlantic free tropospheric humidity deduced from IASI δD Observations” by Lacour Jean.-Lionel et al.

Anonymous Referee #2

In this manuscript, the authors present the isotopic composition of water vapour in the subtropical North Atlantic free troposphere investigated with IASI measurements. This work can be seen as a further step of previous water vapour isotopologues studies carried out in the same region, involving in-situ, ground-based and space-based techniques. In these studies, the observed H_2O - δD distribution was characterized as a function of the origin of the airmasses. Here, the authors focus on summer time, where H_2O - δD distributions show the mixing between dry and depleted upper tropospheric air with humid and enriched boundary layer air transported within the Saharan air layer. The novelty of the work relies on the identification of the Saharan Heat Low (SHL) as the mechanism controlling the moisture budget in the subtropical Atlantic during summer. This work also shows a simple technique for interpreting the inter-annual variations of δD as a function of the fraction of western to eastern airmasses arriving at Izaña.

Overall, this is a well-written and very interesting manuscript. I recommend publication subject to minor revisions.

Specific Comments

The specific comments described below are in relation of a general concern of lack of highlighting previous works developed in this region, which would help to justify the used tools and support the findings.

SC#1. Section 2.1 IASI δD retrievals:

The authors use δD IASI retrievals to demonstrate the role of the SHL on the seasonal cycle of the water isotopologue budget above the North Atlantic in summertime. The 5-year ERC Project MUSICA focused on the long-term, global and high-resolution observations of tropospheric H_2O - δD . This project used Izaña as a multiplatform site for improving the retrievals of ground-based FTIR and IASI sensors, by comparing with in-situ measurements and airborne profiles. Besides the relevance of the named project on the results of this work, there is no specific mention of it. I recommend including in line 20 of section 2.1, the more recent results of IASI observational errors that can be found in Schneider et al. (2015*, 2016, 2017*), and discuss the use of different approximations for the IASI retrievals.

* Schneider et al., Atmos. Meas. Tech., 8, 483–503, doi:10.5194/amt-8-483-2015, 2015

**Schneider et al., Atmos. Meas. Tech., 10, 507-525, doi:10.5194/amt-10-507-2017, 2017.

SC#2. Section 2.2 TES δD retrievals:

Please include a line describing the observational error for TES retrievals (section 2.2).

SC#3. Section 3.1 Seasonal cycle of water vapour and its isotopic composition over Izaña:

Is the composite seasonal cycle representative of different years? Are this data in agreement with the inter-annual variability observed with the in-situ records at Izaña? Please, check and discuss.

SC#4. Section 3.3 Relationship between the SHL and the summer enrichment over the Atlantic:

The four clusters described in the δD - q distribution plot (Figure 5a) were already observed in the situ-measurements at Izaña. Please, link and discuss the observations.

I would also like to see some references on the discussion on the dynamics of the Saharan Air Layer.

SC#6. Please correct typo in page 15, line 17. It is read “2103”, instead of “2013”.